Chapter 10 Static Charges and Energy

What You Will Learn

In this chapter, you will learn how to...

- **relate** your understanding of the atom to the study of electricity and static charges
- **explain** the characteristics of conductors and insulators, and **learn** how different materials allow static charges to be collected or discharged
- **apply** your understanding of electrostatics to describe technologies that control or use static electricity

Why It Matters

Photocopiers, static cling, and lightning are all examples of static electric charges. To someone who lived just 100 years ago, computer scanners and photocopiers might seem to be magical. Each of these inventions, however, is based on our understanding of static charges.

Skills You Will Use

In this chapter, you will learn how to...

- **conduct** experiments to investigate the formation of static charges by friction, contact, and induction, and explain your results with diagrams
- **predict** and **verify** the nature and behaviour of static charges
- **plan** and **carry out** experiments to compare conductivities

A lightning storm can instantly cut all the lights in a community, except those running on emergency batteries or generators. Lightning strikes trigger more than a third of all electrical power outages. Modern electrical science began with attempts to understand lightning and electric charges.

Activity 10-1

Lightning in a Glow Tube

You have seen a lightning bolt light up the sky. In this activity, you will see an electric charge light up a glow tube. How can you use common materials to generate an electric charge that will light up a glow tube?

Materials

- masking tape
- foam cup
- aluminum pie pan
- foam plate
- wool cloth
- neon glow tube

Procedure

1. Work with a partner. Use masking tape to fasten the open end of a foam cup to the inside of an aluminum pie pan, as shown in the set-up.
2. Vigorously rub an upside-down foam plate with a piece of wool cloth for at least 20 s.
3. While holding the cup, place the aluminum pie pan on top of the foam plate.
4. Use a finger of your other hand to touch the aluminum pie pan. Then lift the pie pan away from the plate, using only the foam cup. Do not put down the pie pan.
5. Your partner will hold one of the two metal leads of a neon glow tube in her or his fingers and then touch the other lead to the aluminum pie pan that you are holding.

Questions

1. When you touched the aluminum pie pan with your finger in step 4, did you experience a small electric shock? What could have caused this?
2. Was the glow tube glowing before it touched the pie pan? Did the glow tube glow briefly in step 5? If so, did the glow tube continue to glow after it touched the aluminum pie pan? Explain your observations.

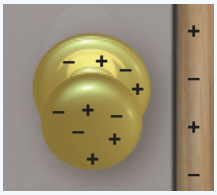
Study Toolkit

These strategies will help you use this textbook to develop your understanding of science concepts and skills.
To find out more about these and other strategies, refer to the Study Toolkit Overview, which begins on page 561.

Reading Graphic Text

Interpreting Diagrams

A diagram can help readers understand complex ideas or explanations. A diagram is a simplified drawing that shows a concept or a process. Symbols are a common feature of diagrams. In the diagrams in this chapter, a plus sign (+) is used to indicate a positive electric charge. A minus sign (-) is used to indicate a negative electric charge. In the diagram below, the number of plus signs is equal to the number of minus signs. These symbols indicate, therefore, that the charges balance. The doorknob is not charged.



Use the Strategy

Browse through this chapter and locate two other diagrams with plus and minus signs. What do the diagrams represent? Discuss your thoughts with a classmate.

Organizing Your Learning

Identifying the Main Idea and Details

The main ideas of a text are supported and explained by *details*, such as facts or examples. It is important to be able to differentiate between the main idea and its supporting details. Phrases such as *for example* and *for instance* are clues that a detail will follow. If you cannot decide whether a sentence is the main idea or a detail, ask yourself, "Is this information the most important thing I need to know, or does this information help me understand the most important thing?"

Use the Strategy

Read the first paragraph in Section 10.1. Determine the main idea and find two supporting details. Compare your findings with those of a partner. Discuss how you decided what the main idea of this paragraph is and what the supporting details are.

Word Study

Word Families

Recognizing that a word belongs to a certain word family can help you grasp the meaning of the word. Words can be related by a common base word. For example, the words in the table below all have a common base: *electro*, meaning electricity. When you see this base in a word, you know that the word has something to do with electricity. If you know or can figure out the meaning of the combining part of the word, you will understand the whole word.

Use the Strategy

Some other words in this chapter also have *electro* as their base. Copy the chart below into your notebook, and add words to it as you read. Try to predict the definition of new words *before* you read their definitions in the text. Check your predictions in the text or in the Glossary at the back of this book.

Analyzing Parts of Words

Word	Base	Combining Part	Definition of Whole Word
electron	electro	on	particle in an atom with a negative electric charge
electroscope	electro	scope	instrument for detecting an electric charge
electrostatic	electro	static	having to do with electric charges that tend to be stationary